TORINO SYSTEM

The Torino System (TS) is a tie-break that has the ambition to solve some problems that the Buchholz System presents when there are unplayed games in the tournament. The method of using the *virtual opponent* for games missing from a player's record and of considering draws the games that a player's opponent did not play, is not completely satisfactory as *unreal* elements have to enter the equation.

The Torino System is a natural system that simply discards each unplayed game from the record of each player and recomputes the whole cross table without the unplayed games. For each player, it basically computes two values, the number of real games (i.e. games played over-the-board) and the points achieved in such games (called ***real points***).

The TS tie-break for a generic player X is given by the sum of the ***real points*** scored by each of his opponents divided by the sum of the real games played by each of his opponents. Then the total is multiplied for a constant *(corrective factor)* in order to return values that are more familiar (and comparable) to the ones everybody is used to.

In more mathematical terms:

BASIC DEFINITIONS

pW	points for a win
pD	points for a draw
pL	points for a loss
Wp	played with White
Bp	played with Black
T	number of rounds in the tournament
$\langle o_i,c_i,r_i \rangle$	way to record a game for a player in a generic round i; it represents a triplet of elements **<opponent, colour, result>**, where **opponent** is a pairing-id (or 0, to identify an unplayed and unscheduled game), **colour** is Wp, Bp or Np (when no game was scheduled or played) and **result** is pW, pD, or pL.
[C?A:B]	Ternary element: if the condition **C** is true, the value of the element is A. Otherwise it is B.

PREPARATION DATA

$\mathbf{gms_{X,n}}$	games actually played over-the-board by player X after n rounds $\sum_{i=1}^{n} [c_i=Np\ ?\ 0 : 1]$
$\mathbf{gms_{X}}$	games actually played over-the-board by player X in the tournament; equivalent to: $\mathbf{gms_{X,T}}$
$\mathbf{rgp_{X,n}}$	real games points, score of player X after n rounds taking into account only games actually played by X over-the-board $\sum_{i=1}^{n} [c_i=Np\ ?\ 0 : r_i]$
$\mathbf{rgp_{X}}$	score of player X in the tournament taking into account only games actually played by X over-the-board; equivalent to: $\mathbf{rgp_{X,T}}$

$ogms_{X,n}$	total number of games actually played over-the-board after n rounds by all X's opponents $\sum_{i=1}^{n} [c_i\text{=Np ? 0 : }gms_{o_i,n}]$
$ogms_X$	total number of games actually played over-the-board in the tournament by all X's opponents $\sum_{i=1}^{T} [c_i\text{=Np ? 0 : }gms_{o_i}]$
$orgp_{X,n}$	(X's) opponents' real game points after n rounds, the sum of the scores of each X's opponent after n rounds, taking into account only games actually played over-the-board by the X's opponent $\sum_{i=1}^{n} [c_i\text{=Np ? 0 : }rgp_{o_i,n}]$
$orgp_X$	(X's) opponents' real game points, the sum of the scores of each X's opponent at the end of the tournament, taking into account only games actually played over-the-board by the X's opponent $\sum_{i=1}^{T} [c_i\text{=Np ? 0 : }rgp_{o_i}]$

TORINO SYSTEM *(for a player* **X***)*

$$\underline{TS(X, n)} = \frac{orgp_{X,n}}{ogms_{X,n}} * n^2 = \frac{\sum_{i=1}^{n} [c_i\text{=Np? 0 : }rgp_{o_i,n}]}{\sum_{i=1}^{n} [c_i\text{=Np? 0 : }gms_{o_i,n}]} * n^2$$

$$\underline{TS(X)} = \frac{orgp_X}{ogms_X} * T^2 = \frac{\sum_{i=1}^{T} [c_i\text{=Np? 0 : }rgp_{o_i}]}{\sum_{i=1}^{T} [c_i\text{=Np? 0 : }gms_{o_i}]} * T^2$$

When a player X plays all its games and X's opponents play all their games, the TS for X is exactly the same as Buchholz.

In fact, Buchholz is the sum of the points scored by each X's opponent. Without unplayed games, for any of these players (i.e. X's opponents) there is no difference between the number of points they scored and their **rgp**(s). Hence the Buchholz of X is equal to the sum of the **rgp**(s) of X's opponents (which is the numerator in the TS formula, also called ORGP)

When there are no unplayed games, each player plays T games. So the denominator in the TS formula (also called OGMS) is T^2 (T-square), which obviously disappears after multiplying by the *corrective factor* (T^2). What remains is exactly the Buchholz.

Here is a recently played tournament with many unplayed games:

ID	Name	Rat.	Pts	Cross Table							Buch	RGP	GMS	TS
2	Cove	2022	7.0	+B14	+W8	+B6	+W1	+B4	+W5	+W7	29.5	7.0	7	30.33
6	VozN	1870	5.0	+W17	+B11	-W2	+B10	-W3	+B9	+W8	28.5	5.0	7	28.86
4	Giac	1928	5.0	+B16	+W18	-B1	+W3	-W2	+BYE	+B24	27.5	4.0	6	28.27
8	Mant	1790	4.5	+W19	-B2	+W14	+B23	+B1	=W24	-B6	29.5	4.5	7	30.48
3	Mach	1975	4.5	+W15	=B10	+W9	-B4	+B6	--	+BYE	28.5	3.5	5	28.10
7	Beru	1852	4.5	-B18	+BYE	+W13	=B15	+W11	+W1	-B2	26.0	3.5	6	27.64
1	Fass	2029	4.0	+W13	+B9	+W4	-B2	-W8	-B7	+W12	31.5	4.0	7	32.12
24	Brac	1399	4.0	+W23	=B5	=W10	=B11	+W13	=B8	-W4	26.0	4.0	7	26.21
9	DiMu	1754	4.0	+B20	-W1	-B3	+W18	+B10	-W6	+W15	25.0	4.0	7	25.06
5	Mazz	1910	3.5	--	=W24	+B16	+BYE	+W15	-B2	-BYE	28.5	2.5	4	29.75
14	CoqL	1632	3.5	-W2	+BYE	-B8	+B17	--	=W10	+B16	25.5	2.5	5	26.60
15	Fior	1616	3.5	-B3	+W22	+B12	=W7	-B5	+W16	-B9	23.5	3.5	7	23.27
13	Vinc	1654	3.5	-B1	+W21	-B7	+W20	-B24	+W23	=B10	22.5	3.5	7	22.22
10	CoqJ	1752	3.0	+B21	=W3	=B24	-W6	-W9	=B14	=W13	26.0	3.0	7	26.25
12	Chia	1702	3.0	--	+B17	-W15	-BYE	+B22	+W20	-B1	20.5	3.0	5	17.61
23	Levi	1427	3.0	-B24	=W16	+B21	-W8	=B18	-B13	+W17	20.0	3.0	7	19.60
20	DelD	1481	3.0	-W9	-BYE	+BYE	-B13	+W21	-B12	+W22	19.0	2.0	5	17.74
11	Arte	1715	2.5	+B22	-W6	+B18	=W24	-B7	-BYE	--	23.0	2.5	5	21.44
18	VozA	1518	2.5	+W7	-B4	-W11	-B9	=W23	-W17	+BYE	22.5	1.5	6	24.50
16	Chiu	1578	2.5	-W4	=B23	-W5	+W22	+B17	-B15	-W14	21.0	2.5	7	20.42
17	Pesc	1538	2.0	-B6	-W12	+B22	-W14	-W16	+B18	-B23	20.5	2.0	7	19.94
22	Acca	1448	1.0	-W11	-B15	-W17	-B16	-W12	+BYE	-B20	19.0	0.0	6	21.10
21	Amad	1464	1.0	-W10	-B13	-W23	+BYE	-B20	--	--	18.5	0.0	4	21.67
19	Bona	1485	0.0	-B8	-BYE	--	--	--	--	--	18.0	0.0	1	31.50

As it can be seen, in this tournament, the different tie-break is not changing the Buchholz order in the top part of the standings. On the other hand, there are some variations in the bottom part of the standings.

TS-Cut1 and TS-Median

The most unnatural part of the Torino System is to define the Cut1 and the Median.

Of course, also TS-Cut1 and TS-Median should give the same results of Buchholz-Cut1 and Buchholz-Median, when there are no unplayed games in the record of X or X's opponents.

Apparently it doesn't seem so difficult: the opponents with the appropriate scores (the lowest and, when requested, the highest) are identified and their points are excluded from the computation of ORGP. Then one or two sets of games are excluded from the OGMS. Finally, if a corrective factor equal to T * (T-1) for Cut1 or T * (T-2) for Median is used, the correspondence is perfectly maintained.

However, the task of excluding a player's output is not immediate. There are at least five possibilities for the low element to cut:

1. (***<u>Points</u>***) the player with the lowest score and the corresponding number of games (the highest number of games in case of parity)
2. (***<u>Games</u>***) the player with the highest number of games (the lowest number of points in case of parity)
3. (***<u>Ratio</u>***) the player with the lowest ratio <number of points, number of games> (the highest number of games in case of parity)
4. (***<u>High</u>***) the lowest number of points and the highest number of games
5. (***<u>Target</u>***) the player whose exclusion would generate the highest value for the tie-break

Of course, exchange lowest <=> highest, when talking of the high element to cut.

However, a further consideration is peculiar to the Torino System: what to do if X has not played all his games?

6. (***<u>None</u>***) if a game is missing, the ORGP/OGMS ratio does not change (only the *corrective factor* will vary)

The alternative, of course, is to exclude something anyway along the lines seen above.

In FIDE standard tie-breaks, a similar problem exists with AROC (the average rating of the opponent after cutting the lowest average) and it is *solved* in a way (the lowest average is cut anyway, even when a player hadn't played all his games) that some people consider unsatisfactory.

Referring to the previous tournament, here is a table valid for Cut1 considerations:

ID		Cross Table							RGP	G	Buch	TS	B-1	Points	Games	Ratio	High	Target	None
1	4.0	+W13	+B9	+W4	-B2	-W8	-B7	+W12	4.0	7	31.5	32.12	28.0	27.82	28.74	28.74	29.29	28.74	
2	7.0	+B14	+W8	+B6	+W1	+B4	+W5	+W7	7.0	7	29.5	30.33	26.0	26.68	26.40	26.68	28.20	26.68	
3	4.5	+W15	=B10	+W9	-B4	+B6	--	+BYE	3.5	5	28.5	28.10	25.5	25.67	25.67	25.67	25.67	25.67	24.09
4	5.0	+B16	+W18	-B1	+W3	-W2	+BYE	+B24	4.0	6	27.5	28.27	25.5	26.73	26.25	26.73	27.56	26.73	24.23
5	3.5	--	=W24	+B16	+BYE	+W15	-B2	-BYE	2.5	4	28.5	29.75	26.0	29.00	29.00	29.00	29.00	29.00	25.50
6	5.0	+W17	+B11	-W2	+B10	-W3	+B9	+W8	5.0	7	28.5	28.86	26.5	27.08	27.08	27.08	27.08	27.08	
7	4.5	-B18	+BYE	+W13	=B15	+W11	+W1	-B2	3.5	6	26.0	27.64	24.0	26.09	24.28	26.09	26.91	26.09	23.69
8	4.5	+W19	-B2	+W14	+B23	+B1	=W24	-B6	4.5	7	29.5	30.48	26.5	26.77	27.79	26.77	31.50	27.79	
9	4.0	+B20	-W1	-B3	+W18	+B10	-W6	+W15	4.0	7	25.0	25.06	23.0	23.21	22.14	23.21	23.84	23.21	
10	3.0	+B21	=W3	=B24	-W6	-W9	=B14	=W13	3.0	7	26.0	26.25	24.5	24.87	22.80	24.87	27.00	24.87	
11	2.5	+B22	-W6	+B18	=W24	-B7	-BYE	--	2.5	5	23.0	21.44	22.5	22.62	16.80	22.62	23.52	22.62	18.38
12	3.0	--	+B17	-W15	-BYE	+B22	+W20	-B1	3.0	5	20.5	17.61	20.0	18.58	15.96	18.58	19.32	18.58	15.09
13	3.5	-B1	+W21	-B7	+W20	-B24	+W23	=B10	3.5	7	22.5	22.22	21.0	21.00	19.25	21.00	22.75	21.00	
14	3.5	-W2	+BYE	-B8	+B17	--	=W10	+B16	2.5	5	25.5	26.60	23.5	25.50	25.50	25.50	25.50	25.50	22.80
15	3.5	-B3	+W22	+B12	=W7	-B5	+W16	-B9	3.5	7	23.5	23.27	23.0	23.47	21.00	23.47	24.18	23.47	
16	2.5	-W4	=B23	-W5	+W22	+B17	-B15	-W14	2.5	7	21.0	20.42	20.5	20.42	18.60	20.42	21.00	20.42	
17	2.0	-B6	-W12	+B22	-W14	-W16	+B18	-B23	2.0	7	20.5	19.94	20.0	19.86	17.50	19.86	20.42	19.86	
18	2.5	+W7	-B4	-W11	-B9	=W23	-W17	+BYE	1.5	6	22.5	24.50	21.0	23.03	23.03	23.03	23.03	23.03	21.00
19	0.0	-B8	-BYE	--	--	--	--	--	0.0	1	18.0	31.50	17.0	0.00	0.00	0.00	0.00	0.00	27.00
20	3.0	-W9	-BYE	+BYE	-B13	+W21	-B12	+W22	2.0	5	19.0	17.74	18.5	19.17	13.36	19.17	20.05	19.17	15.21
21	1.0	-W10	-B13	-W23	+BYE	-B20	--	--	0.0	4	18.5	21.67	17.0	19.00	18.79	19.00	21.00	19.00	18.58
22	1.0	-W11	-B15	-W17	-B16	-W12	+BYE	-B20	0.0	6	19.0	21.10	18.5	19.55	19.55	19.55	19.55	19.55	18.08
23	3.0	-B24	=W16	+B21	-W8	=B18	-B13	+W17	3.0	7	20.0	19.60	18.5	18.44	17.68	18.44	19.89	18.44	
24	4.0	+W23	=B5	=W10	+B11	+W13	=B8	-W4	4.0	7	26.0	26.21	23.0	22.66	23.33	23.33	23.92	23.33	

In order to choose among the six alternatives (of Cut-1) some considerations are made. Values in red signal that the Cut1 values are higher than the basic values (which is an anomaly). Values in blue require some commentary.

- the ***None*** alternative seems illogical for the Median computation: if one game is missing, was it the correspondent to the lowest or the highest score? How can another game be choosen?
- although the ***Games*** alternative does not present any red anomaly, it is not very logical: the goal of Cut1 is to eliminate the worst opponent and, with the ***Games*** alternative, the eliminated player could be the best of the bunch if he were the only opponent to play the maximum number of games; look, for instance, at what happens to player #11, who has to discard #24
- the ***Points*** alternative is decent, but it may cut a player who made a good tournament, playing a lower number of games; for instance the #1 would discard #12, who scored 3 points in 5 games; it would be better for him to discard #13 who made 3½ in 7 seven games
- the ***Ratio*** alternative is the most logical, at this point. However, having the possibility, would #8 rather discard #19 (0 points in 1 game) or #23 (3 points in 7 games)? His opponents score 25½ points in 41 games. Excluding #19, the opponents have 25½ points in 40 games. Excluding #23, 22½ points in 34 games. The latter nets a higher value for the tiebreak
- so, everything comes to the ***Target*** alternative: it is not the easiest to compute, but it is the fairest. It often works like the ***Ratio*** alternative, but it may improve the tie-break score of a player, when there are weird situations (like the one involving #8, who was the only one who faced #19)
- the last alternative, ***High***, is the most favorable for the tie-breaking player (as it cuts a low value from the numerator and a high value for the denominator), but it is artificial and, therefore, it would infringe the character of TS that presents itself like a natural system

In the end, it seems that the ***Target*** alternative should be used.

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